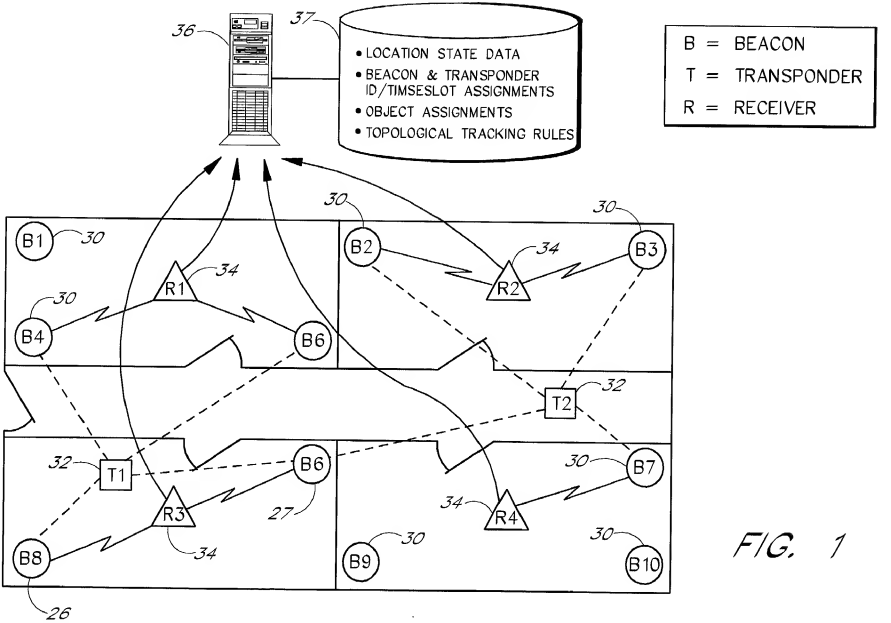
36
37
• LOCATION STATE DATA
• BEACON & TRANSPONDER ID/TIMSESLOT ASSIGNMENTS
• OBJECT ASSIGNMENTS
• TOPOLOGICAL TRACKING RULES
B = BEACON
T = TRANSPONDER
R = RECEIVER
B1
B2
B3
B4
B6
B7
B8
B9
B10
R1
R2
R3
R4
T1
T2
30
32
34
27
26

FIG. 1

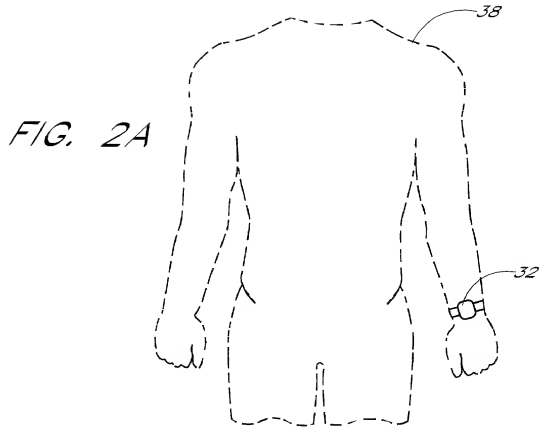

FIG. 2A

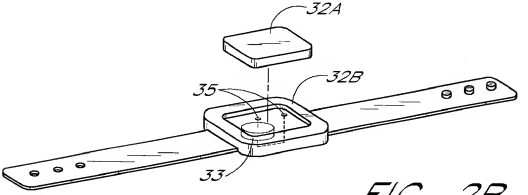

FIG. 2B

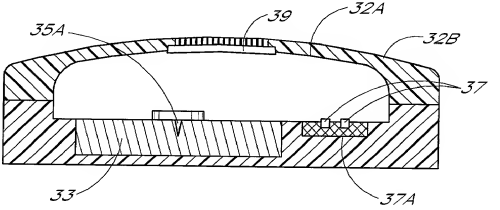

FIG. 2C

FOUO FOUO

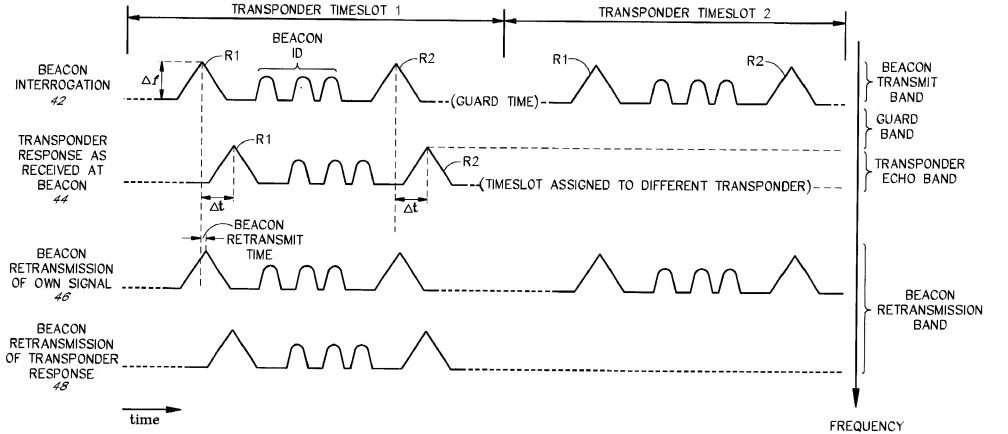

FIG. 3A

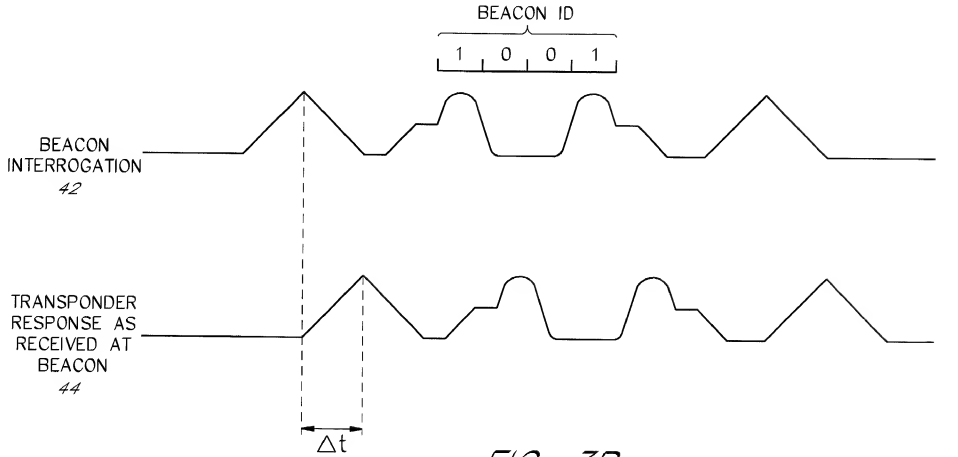
BEACON ID
1 0 0 1
BEACON INTERROGATION
42
TRANSPONDER RESPONSE AS RECEIVED AT BEACON
44
Δt

FIG. 3B

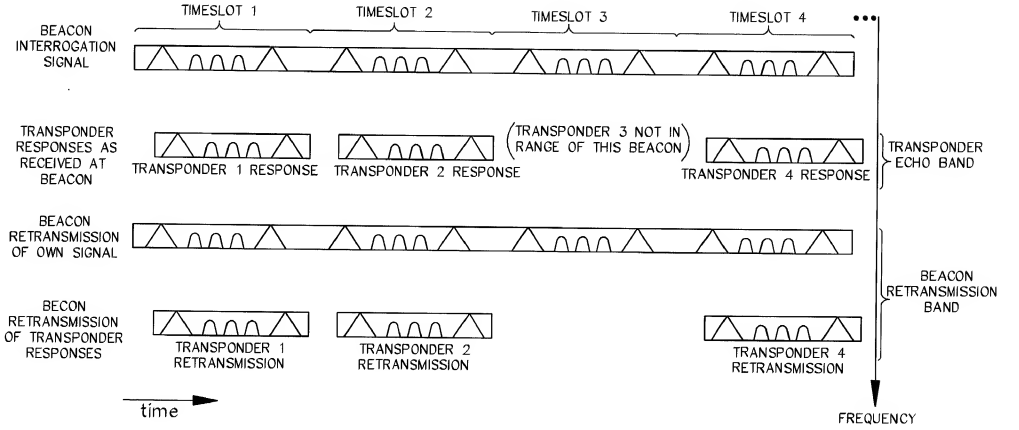
TIMESLOT 1
TIMESLOT 2
TIMESLOT 3
TIMESLOT 4
BEACON INTERROGATION SIGNAL
TRANSPONDER RESPONSES AS RECEIVED AT BEACON
TRANSPONDER 1 RESPONSE
TRANSPONDER 2 RESPONSE
TRANSPONDER 3 NOT IN RANGE OF THIS BEACON
TRANSPONDER 4 RESPONSE
TRANSPONDER ECHO BAND
BEACON RETRANSMISSION OF OWN SIGNAL
BECON RETRANSMISSION OF TRANSPONDER RESPONSES
TRANSPONDER 1 RETRANSMISSION
TRANSPONDER 2 RETRANSMISSION
TRANSPONDER 4 RETRANSMISSION
BEACON RETRANSMISSION BAND
time
FREQUENCY

FIG. 4

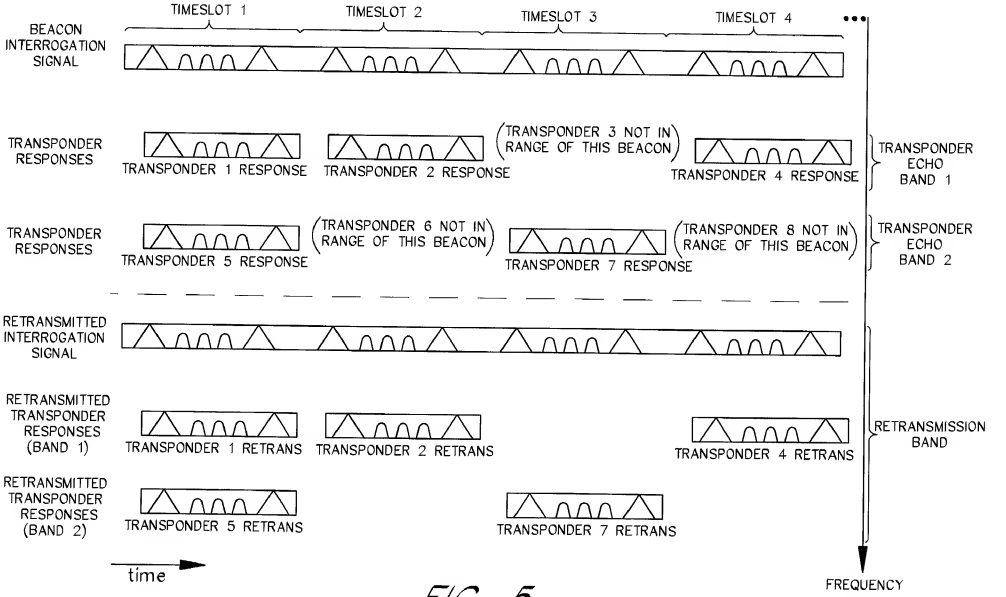
TIMESLOT 1
TIMESLOT 2
TIMESLOT 3
TIMESLOT 4
BEACON INTERROGATION SIGNAL
TRANSPONDER RESPONSES
TRANSPONDER 1 RESPONSE
TRANSPONDER 2 RESPONSE
TRANSPONDER 3 NOT IN RANGE OF THIS BEACON
TRANSPONDER 4 RESPONSE
TRANSPONDER ECHO BAND 1
TRANSPONDER RESPONSES
TRANSPONDER 5 RESPONSE
TRANSPONDER 6 NOT IN RANGE OF THIS BEACON
TRANSPONDER 7 RESPONSE
TRANSPONDER 8 NOT IN RANGE OF THIS BEACON
TRANSPONDER ECHO BAND 2
RETRANSMITTED INTERROGATION SIGNAL
RETRANSMITTED TRANSPONDER RESPONSES (BAND 1)
TRANSPONDER 1 RETRANS
TRANSPONDER 2 RETRANS
TRANSPONDER 4 RETRANS
RETRANSMISSION BAND
RETRANSMITTED TRANSPONDER RESPONSES (BAND 2)
TRANSPONDER 5 RETRANS
TRANSPONDER 7 RETRANS
time
FREQUENCY

FIG. 5

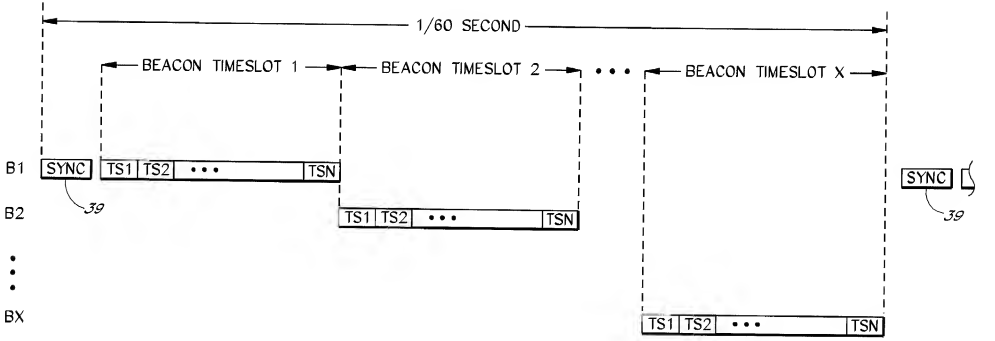
1/60 SECOND
BEACON TIMESLOT 1
BEACON TIMESLOT 2
BEACON TIMESLOT X
B1
B2
BX
SYNC
TS1
TS2
TSN
39

FIG. 6

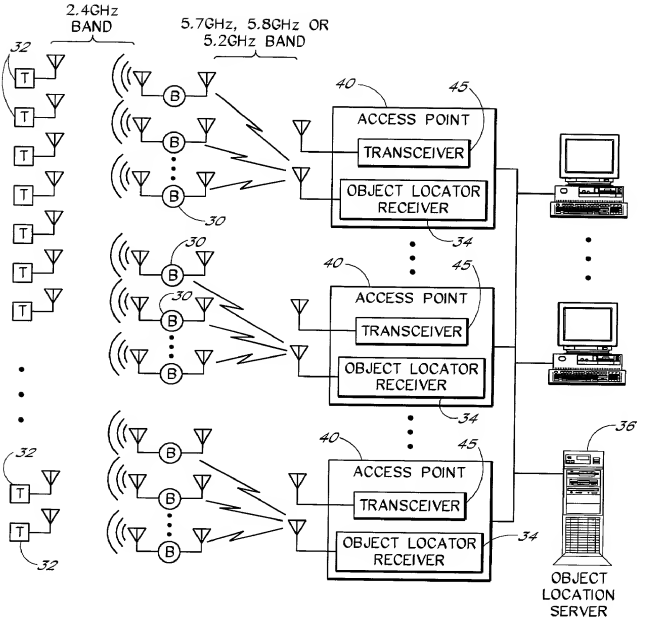
2.4GHz
BAND
5.7GHz, 5.8GHz OR
5.2GHz BAND
32
T
B
30
40
45
ACCESS POINT
TRANSCEIVER
OBJECT LOCATOR
RECEIVER
34
36
OBJECT
LOCATION
SERVER

FIG. 7

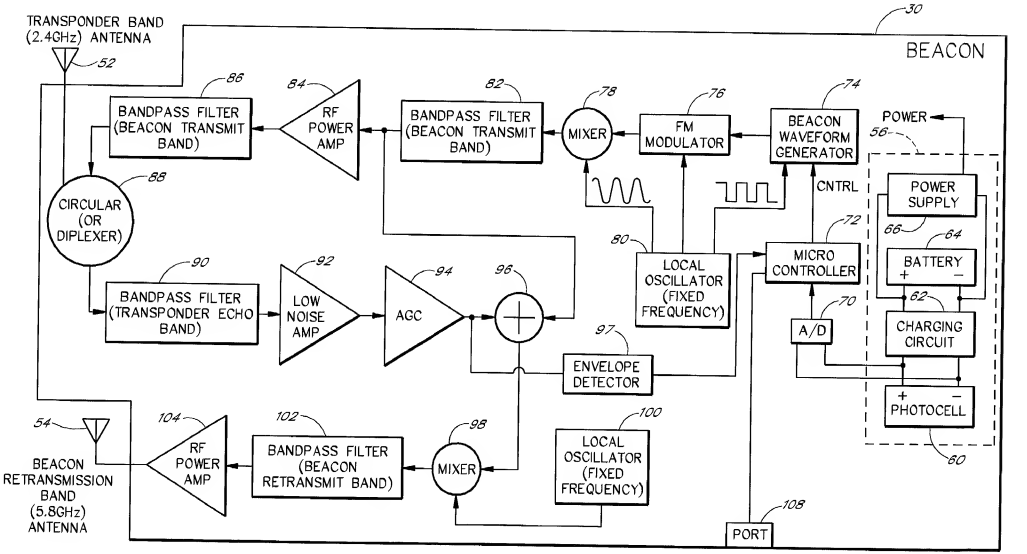
TRANSPONDER BAND
(2.4GHz) ANTENNA
52
30
BEACON
86
BANDPASS FILTER
(BEACON TRANSMIT
BAND)
84
RF
POWER
AMP
82
BANDPASS FILTER
(BEACON TRANSMIT
BAND)
78
MIXER
76
FM
MODULATOR
74
BEACON
WAVEFORM
GENERATOR
POWER
56
CNTRL
88
CIRCULAR
(OR
DIPLEXER)
POWER
SUPPLY
66
64
BATTERY
+ −
80
LOCAL
OSCILLATOR
(FIXED
FREQUENCY)
72
MICRO
CONTROLLER
62
CHARGING
CIRCUIT
70
A/D
90
BANDPASS FILTER
(TRANSPONDER ECHO
BAND)
92
LOW
NOISE
AMP
94
AGC
96
97
ENVELOPE
DETECTOR
+ −
PHOTOCELL
60
54
BEACON
RETRANSMISSION
BAND
(5.8GHz)
ANTENNA
104
RF
POWER
AMP
102
BANDPASS FILTER
(BEACON
RETRANSMIT BAND)
98
MIXER
100
LOCAL
OSCILLATOR
(FIXED
FREQUENCY)
108
PORT

FIG. 8

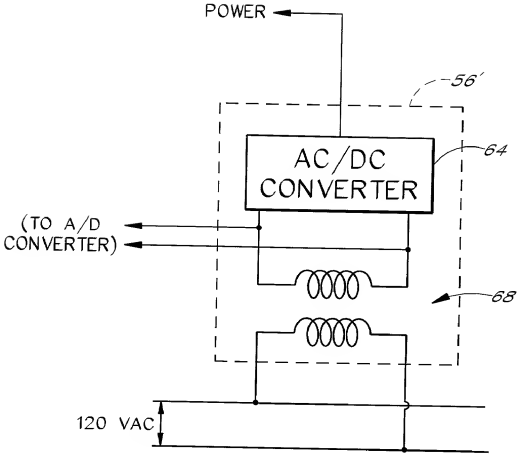

FIG. 9

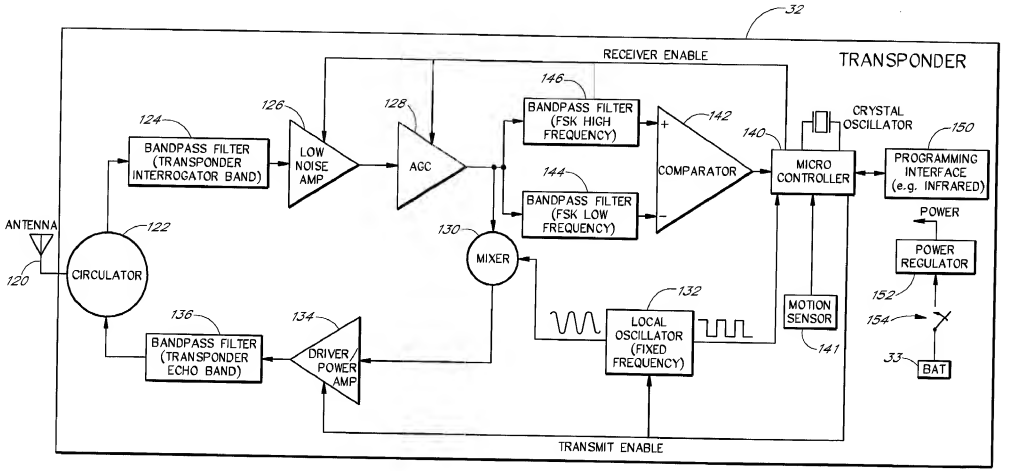
32
TRANSPONDER
RECEIVER ENABLE
ANTENNA
120
CIRCULATOR
122
124
BANDPASS FILTER (TRANSPONDER INTERROGATOR BAND)
126
LOW NOISE AMP
128
AGC
130
MIXER
146
BANDPASS FILTER (FSK HIGH FREQUENCY)
144
BANDPASS FILTER (FSK LOW FREQUENCY)
142
COMPARATOR
+
-
140
MICRO CONTROLLER
CRYSTAL OSCILLATOR
150
PROGRAMMING INTERFACE (e.g. INFRARED)
POWER
POWER REGULATOR
152
154
33
BAT
132
LOCAL OSCILLATOR (FIXED FREQUENCY)
MOTION SENSOR
141
134
DRIVER/ POWER AMP
136
BANDPASS FILTER (TRANSPONDER ECHO BAND)
TRANSMIT ENABLE

FIG. 10

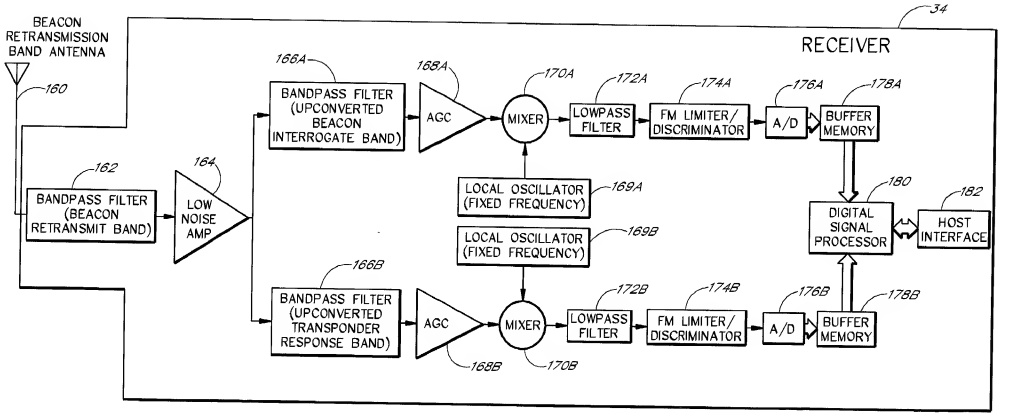
BEACON RETRANSMISSION BAND ANTENNA
160
34
RECEIVER
162
BANDPASS FILTER (BEACON RETRANSMIT BAND)
164
LOW NOISE AMP
166A
BANDPASS FILTER (UPCONVERTED BEACON INTERROGATE BAND)
168A
AGC
170A
MIXER
172A
LOWPASS FILTER
174A
FM LIMITER/ DISCRIMINATOR
176A
A/D
178A
BUFFER MEMORY
169A
LOCAL OSCILLATOR (FIXED FREQUENCY)
169B
LOCAL OSCILLATOR (FIXED FREQUENCY)
180
DIGITAL SIGNAL PROCESSOR
182
HOST INTERFACE
166B
BANDPASS FILTER (UPCONVERTED TRANSPONDER RESPONSE BAND)
168B
AGC
170B
MIXER
172B
LOWPASS FILTER
174B
FM LIMITER/ DISCRIMINATOR
176B
A/D
178B
BUFFER MEMORY

FIG. 11

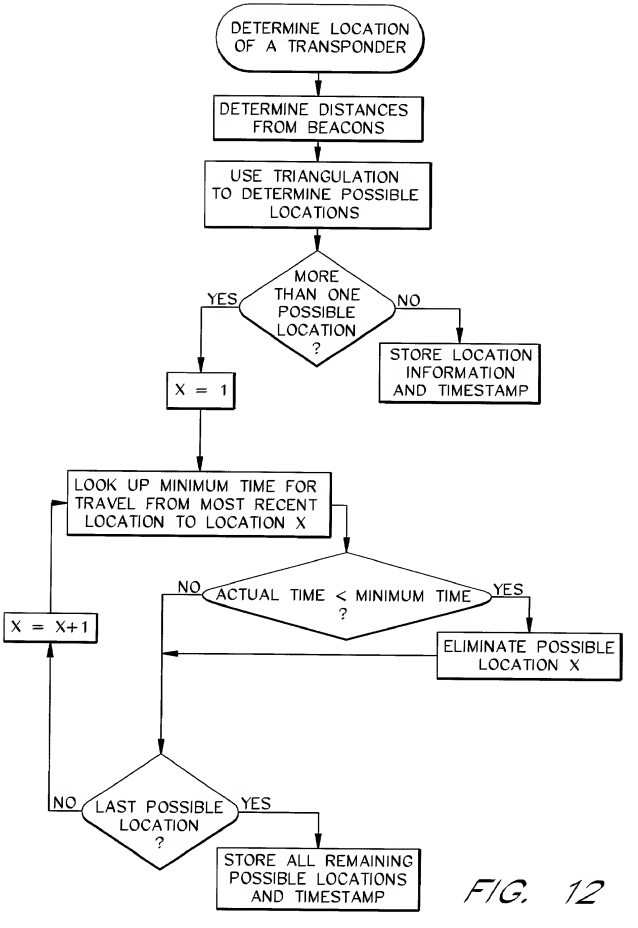
DETERMINE LOCATION OF A TRANSPONDER
DETERMINE DISTANCES FROM BEACONS
USE TRIANGULATION TO DETERMINE POSSIBLE LOCATIONS
MORE THAN ONE POSSIBLE LOCATION ?
YES
NO
STORE LOCATION INFORMATION AND TIMESTAMP
X = 1
LOOK UP MINIMUM TIME FOR TRAVEL FROM MOST RECENT LOCATION TO LOCATION X
ACTUAL TIME < MINIMUM TIME ?
NO
YES
ELIMINATE POSSIBLE LOCATION X
X = X+1
LAST POSSIBLE LOCATION ?
NO
YES
STORE ALL REMAINING POSSIBLE LOCATIONS AND TIMESTAMP

FIG. 12